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True Cost-Finding—What It Can Do for the Railroads¹

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NO uniform system of cost-finding has ever been nationally applied to American railroads. One is tempted to make this statement much stronger and say that on no American railroad is there to be found a system of cost-finding comparable to the better systems in vogue in other industries. Such cost-finding would improve efficiency and service, reduce expenses, furnish a scientific basis for freight and passenger rates, inspire public confidence in the management, and ultimately bring about standard operating methods. The cost factor is the best measure of performance known, regardless of whether the performance desired be war-making capacity, reasonable freight or passenger rates, economy in labor or material, returns on the dollar invested, or any other.

EXISTING FALLACIES REGARDING COST-FINDING

In discussing the problem of cost-finding there are three fallacies which must first be cleared away:

1. The fallacy that confuses statistics with costs—the great mass of operating statistics pertaining to railroads have little bearing on true costs.
2. The fallacy that it is difficult to apply cost-finding to railroad operations, and that a national standard would upset present management.
3. The fallacy that cost-finding is purely a money-saving proposition.

1. The United States Railroad Administration has already installed a system of uniform operating statistics, through its Division of Operation which is described elsewhere in this volume. This seems to be admirably designed but the reports show in

¹ This article in some what different form appeared in the January (1919) issue of *Industrial Engineer*. It is reproduced here with the permission of the editor of that publication.—THE EDITOR.

averages and ratios only the extent to which present facilities are used. They call attention to equipment capable of better use. They also provide for some accounting information of a general nature, valuable as a general survey.

True cost reports would trace every item of expense to its place in a unit of operation or service. Each unit of expense could be analyzed in terms of maintenance, labor, material, administration, construction, etc. Cost-finding methods would not only be uniform on all railroads under the centralized administration, but there would be the same cost terminology. Uniformity would enable those at interest to trace differences in cost to real causes without time-consuming investigations.

For instance, in any unit of cost the general item "Maintenance" might be subdivided into:

- (a) Tracks and roadway.
- (b) Rolling stock.
- (c) Terminals.
- (d) Power stations, etc.

Any of these items might be further subdivided one or more times to whatever extent the data may be useful or desirable. To illustrate, the first item—the cost of maintenance of tracks and roadway—might be expressed both as totals and in terms of units under some such head and subheads as the following:

Cost of ties	Cost of finished rails, delivered at
Cutting timber	warehouse
Creosoting	Delivery to point of use
Hauling	Laying rails
Placing in roadbed	Riveting
Leveling	Spiking, etc.
Cost of rails	

2. A uniform cost-finding system should not interfere with present railroad routine, for a national standard would be developed as a matter of growth rather than the adoption of a ready-made system. One or two typical railroads could be chosen to carry on the work during the development stage. No general announcement need be made. The introduction of such a program should be slow and gradual.

3. Scientific cost information almost invariably brings about economies because it directs attention to abnormalities. Money

saving is important. But accurate cost statistics are even more valuable as a foot-rule for measuring efficiency. During a war, for example, service is more vital than economy. Yet even in the midst of war accurate cost data will indicate wastage of manpower, of materials, of equipment, etc., our war-making capacity being more important than economy, at such a time, accurate data improve war-making capacity.

WHAT COST-FINDING CAN DO AT THIS TIME

The Government has now absolute control of railroad operation. It desires to operate as efficiently as possible, for public service. There is an unusual opportunity to establish cost-finding—an opportunity quite unlikely to occur under private control. Private railroad management is governed by policies regarded as of immediate importance to the particular railroad, or system, or group of financiers, or stockholders. Competition between railroads formerly made broad standardization of cost methods difficult.

Railroad rates have been the subject of interminable disputes in the past. The public believes that freight and passenger rates are either too high or out of balance. Railroad officials under private ownership have been convinced that rates were neither justly nor scientifically computed. Such disputes have been based largely upon general railroad statistics, instead of accurate cost information. Very often they have revolved upon mere statements of opinion, or broad generalizations incapable of demonstration. Between the public and the railroads the Interstate Commerce Commission has arbitrated, but without accurate cost data as an irrefutable basis for decisions. Uniform cost methods would make rate decisions very largely a scientific process, eliminate much of the argument, and more nearly satisfy both sides in the disputes.

Accurate detailed cost data almost invariably lower expenses and prices in other industries. They should lower railroad rates and give more favorable prices for American goods in foreign markets. In view of the large merchant marine now being built this is an important consideration.

Furthermore, it is important that public confidence in railroad operation whether operated by the government or private interests

be firmly established. Accurate cost-finding is such a vital element in modern industry that the public will expect this phase of good administration.

As Mr. Cunningham has pointed out in his article on railroad statistics the Interstate Commerce Commission has already very fully carried out the instructions of Congress in the matter of establishing uniform accounting methods on American railroads. When it comes to developing adequate cost-finding methods, however, it will probably be discovered that a somewhat different basis for railroad accounting will be the outcome, enabling the taking off of special reports and the making of special statistical inquiries with a fraction of the trouble now involved. These special reports are now a well-nigh maddening part of the duties of railroad accountants. Under private operation and Federal regulation they would become even more of a nuisance than at present. Hence the railroad world will welcome any improvement in the technique of accounting methods which will yield special data and information more readily than under the present system.

Fortunately we can point to one concern¹ which has in use on certain utility properties which it operates, a very satisfactory system of cost-finding, which in its main features and more especially in its mechanism might easily be adapted to steam railroad use.

HOW COST-FINDING CAN BE APPLIED TO THE RAILROADS

The first step is to make a careful study of all previous attempts at cost-finding on railroads, as well as similar public utilities. These attempts have been isolated. Preference should be given to cost systems in successful operation. Both the systems and their methods of installation should be reduced to standards which are approximately correct, and will not interfere at all with operating efficiency. This will give a basis for introducing a tentative system on one or more important railroads, and extending the systems as fast as perfected, to the extent that may be desired.

Some of the obvious ends to be accomplished are:

(a) Comparisons between different railroads of actual ton-

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mile, train-mile and car-mile costs, subdivided into component parts.

(b) Comparisons of similar costs between various sections of the same railroad, and between railroads covering same territory.

(c) Comparisons between groups of commodities handled on the same railroad, and between two or more railroads handling the same commodities.

(d) Comparisons between various kinds of service (car-load lots, less-than-car lots, terminal facilities, switching facilities) on the same railroad and between two or more railroads, of costs of the same service.

(e) Comparisons between costs of operating various kinds of equipment (steel gondolas, wooden cars, cars of various capacities, freight trains, mixed trains, special trains, etc.) upon the same railroad; and between two or more railroads upon the same kind of equipment.

(f) Comparisons of special elements of costs, such as direct wages, direct materials, direct expenses, as well as indirect or overhead charges (both before and after allocation) on the same railroad, as applied to the information indicated in (a), (b), (c), (d), and (e).

(g) Separate costs of construction, operation and maintenance and comparisons of the subdivisions of these costs somewhat as in the following illustration, taken from the records of a company now employing a comprehensive cost-finding method:

OPERATION COSTS

	1917	1918
General.....	\$.0286	\$.0283
Transportation.....	.0906	.0843
Distribution.....	.0004	.0003
Traffic.....	.0005	.0008
Production.....	.0786	.0445
Roadway.....	.0018	.0016
Transmission.....	.0022	.0021
	<hr/>	<hr/>
Total cost per unit.....	\$.2027	\$.1619

MAINTENANCE COSTS

General.....	\$.0001	\$.0002
Transportation.....	.0111	.0092
Distribution.....	.0020	.0016

Traffic	\$.0042	\$.0034
Production		
Roadway0149	.0114
Transmission0002	.0004
<hr/>		
Total cost per unit	\$.0325	\$.0262
Grand total cost per unit	\$.2352	\$.1881

(h) The arrangement of the foregoing analyses in such a manner that differences in costs are easily detected by those who use the data.

(i) Original records maintained in such form and in such detail that the information they convey can at any time in the future be assembled by machinery to produce whatever class of cost statistics may be desired without an exhaustive and costly investigation. Thus, in addition to such cost reports as may be required at regular periods, it would be a simple matter to make any kind of special cost analysis by machine, cheaply, at a moment's notice.

To produce the comparative cost statistics above indicated, it is necessary that the cost-finding systems include the following features:

Inclusion of each item of cost applicable to a given period of time, whether represented by current outlay of money or by the consumption of material, equipment or service paid for during a previous period, or to be paid for during a later period. Thus the cost of hauling a car-mile of a given class of commodity over a given section of track, would include not only every cent of direct wages, direct material and direct expense applicable to the particular period under review, but would include also its proper proportion of interest charges, maintenance of way charges, equipment, depreciation, equipment repair expenses, general expenses, etc. The situation would be analogous to that of an automobile manufacturer, for example, who is in a position to know the exact cost of an axle or a differential or of a thousand small bolts of a particular description, etc.

The method of recording costs must be uniform, to avoid the distortions which might take place were the decision as to how any particular element of costs is to be classified left to the discretion of each individual railroad statistician.

For similar reasons, terminology must be standardized upon all roads—a descriptive name must mean the same thing wherever and by whomever it is employed.

The system should be elastic, in that it would permit periodical expansion and detailed analysis of particular phases of costs which are not normally of current interest because they would not vary materially from one period to another. Some of the comparisons mentioned under (a), (b), (e), and (f) above, would only be made at intervals as may be expedient. The corollary to this expansibility would be easy contractibility. As quickly as the information sought has been produced, the work should revert to its current form without having caused any unusual disturbance.

The structure of such a uniform system of cost-finding necessarily would be the result of careful study of all the factors involved in the situation. In general it would rest upon the accurate recording of each detailed expenditure in such a manner that the record could be easily assembled with others of like character, eventually finding its way through a series of assortings and further assemblies into its proper niche. It is possible through the use of various mechanical devices to reduce nearly all the work to machinery. Electrical assorting and tabulating machines, such as used by the Census Bureau, are essential factors in such work. Mechanical devices reduce almost at once the existing cost of performing work of this kind. They should not be regarded as additional items of expense.

Unfortunately in the past railroad men as a rule have been rather pessimistic both as to the possibility of securing costs and as to their utility even if obtained. Thus in a rate case before the Pennsylvania Public Service Commission, these two typical expressions of opinion by representative railroad men appear in the testimony:

Theodore Voorhees, President, Philadelphia & Reading Railroad:

You cannot get at the cost of any item of railroad service. . . . It never has been done. I do not believe it ever will be done.

Robert H. Large, General Coal Freight Agent, Pennsylvania R. R.:

You can't take into consideration the cost of the service for two reasons. In the first place, you can't ascertain the cost. That is practically impossible, in freight traffic between commodities.

Fortunately, the whole attitude of the railroad world is changing and it is coming to be recognized that in many respects railroad costs are easy of ascertainment, as compared with industrial costs. Certainly once obtained they will be quite as useful.

The entire subject of course has been before the railroad world for years past. Mr. Louis D. Brandeis—now Mr. Justice Brandeis—in his book *Business a Profession*, says:

The first step in applying the principle of the sliding scale to railroading must be, however, to devise means of determining degrees of efficiency and that involves determining the unit cost for each operation on each railroad. Unless costs are so ascertained, no true measure of efficiency can be arrived at. The knowledge that the average annual cost per locomotive for repairs, renewals and depreciation on one railroad is \$3,832.37 and on another is \$2,709.27 would be a very unsafe ground for determining the relative economy of operation on the two railroads. The conditions on the two railroads and the standard of renewal and depreciation may vary so greatly that the company expending the greater sum may actually have conducted its locomotive use and repairs more economically and efficiently than the railroad expending less. We must reduce each operation to its ultimate unit and ascertain the cost of that before a proper basis of comparison can be secured. We must learn not merely the cost of turning a wheel of standard size and character, the cost of laying a tie or rail under standard conditions; but even these relatively simple operations must be again analyzed and separated into their component elements before a safe basis of relative costs can be arrived at.

The fact that railroads are subject in their accounting to the orders of the Interstate Commerce Commission makes it possible to require that each company should ascertain and report to the commission the ultimate unit costs of each operation in each department of the railroad. The further fact that the railroad business is largely non-competitive, makes it proper to publish these costs and to give to each railroad the benefit of knowing the lowest unit cost of each operation attained by any railroad and how it was attained.

To aid in this work the Interstate Commerce Commission should establish a Bureau of Railroad Costs by which the ascertainment of costs may be supervised and the results analyzed, classified and compared. Knowledge of the best methods would thus become the common property of railroad men. That alone would lead directly to great advances in efficiency and economy. But the adoption of the best existing methods would be merely the beginning of the great advance. The ascertainment of the lowest existing costs would inevitably be followed by widespread striving to eliminate further waste of time, effort and material and to find ever better methods. With the introduction of exact tests of efficiency, with the establishment of dependable standards of comparison,

railroad operation would soon develop into a recognized profession; and those who pursue it would be stimulated like scientists and engineers to ever higher achievements.

The amount of progress which has been made in this matter of cost-finding on the railroads during the last ten years does not encourage one to hope that any line of action which it would be wise for the United States Railroad Administration to adopt just now would lead immediately to any broadly satisfactory or final solution. A development of this character in railroad administration should preferably, of course, be very largely the result of work originating at a number of different points. It is entirely proper, even necessary, for the top to direct, to guide, and to inspire. We have the right to expect that any centralized control or regulation of the railroads should express a deep concern as to railroad costs and at least to coördinate the procedures which will ultimately give us accurate railroad costs. But any such steps taken in Washington must needs be supplemented by a corresponding interest on each individual railroad. No railroad can by itself hope to set the standard for the country. Coöperation is as inherent in the development of cost-finding methods as in anything else. But it will be a very difficult if not impossible task for the United States Railroad Administration or the Interstate Commerce Commission to scheme out an adequate system of cost-finding methods in the absence of a widespread interest in the matter among railroad executives. In other words, either the Railroad Administration or the Commerce Commission must, and undoubtedly will, take the lead in this matter, but in the accomplishment of any worth-while result the help of all forward looking railroad men will be required.